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S E Q U E N T P l u g & D r i v e



Rev-B

2009 CHEVROLET 3.9L IMPALA
CNG SYSTEM INSTALLER'S GUIDE

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SAFETY



WARNING!

READ BEFORE PERFORMING ANY INSTALLATION, SERVICE, MAINTANENCE OR REPAIR ON THE FUEL SYSTEM

There are safety regulations and standards that must be followed when installing or servicing gaseous fuel equipment. It is highly recommended you obtain and read the following National Fire Protection Association (NFPA) guidelines:

SERVICE TECHNICIANS AND USERS:

CAREFULLY READ AND ABIDE BY THE PROVISIONS SET FORTH IN NATIONAL FIRE PROTECTION ASSOCIATION PAMPHLET #37 FOR STATIONARY ENGINES, #52 FOR CNG VEHICULAR FUEL SYSTEMS OR #58 FOR LPG SYSTEMS.

INSTALLERS:

LPG INSTALLATIONS IN THE UNITED STATES MUST BE DONE IN ACCORDANCE WITH FEDERAL STATE OR LOCAL LAW, WHICHEVER IS APPLICABLE AND NATIONAL FIRE PROTECTION ASSOCIATION PAMPHLET #58, STANDARD FOR STORAGE AND HANDLING OF LIQUIFIED PETROLEUM GASES TO THE EXTENT THESE STANDARDS ARE NOT IN VIOLATON WITH FEDERAL, STATE OR LOCAL LAW.

IN CANADA REFER TO CAN/CGA PROPANE INSTALLATION CODES.

CNG INSTALLATIONS IN THE UNITED STATES MUST BE DONE IN ACCORDANCE WITH FEDERAL STATE OR LOCAL LAW AND NATIONAL FIRE PROTECTION ASSOCIATION PAMPHLET #52, COMPRESSED NATURAL GAS (CNG) VEHICULAR FUEL SYSTEMS TO THE EXTENT THESE STANDARDS ARE NOT IN VIOLATION WITH FEDERAL, STATE OR LOCAL LAW.

IN CANADA REFER TO CAN/CGA CNG INSTALLATION CODES.

LPG AND/OR NATURAL GAS INSTALLATIONS ON STATIONARY ENGINES MUST RE DONE IN ACCORDANCE WITH FEDERAL, STATE OR LOCAL LAW AND NATIONAL FIRE PROTECTION ASSOCIATION PAMPHLET #37, STATIONARY COMBUSTION ENGINES AND GAS TURBINE ENGINES, TO THE EXTENT THESE STANDARDS ARE NOT IN VIOLATION WITH FEDERAL, STATE OR LOCAL LAW. FAILURE TO ABIDE BY THE ABOVE WILL VOID ANY IMPCO WARRANTY ON THE PRODUCTS AND MAY CAUSE SERIUS INJURY OR PROPERTY DAMAGE.

DUE TO THE INHERENT DANGER OF GASEOUS FUELS, THE IMPCO PRODUCTS SHOULD NOT BE INSTALLED OR USED BY PERSONS NOT KNOWABLE OF THE HAZARDS ASSOCIATED WITH THE USE OF GASEOUS FUELS.

To order these documents, call the NFPA @ 800 344-3555 or go to www.nfpa.org.

There are state standards and regulations enforced by the state fire marshal in most states. In Texas, the Texas State Railroad Commission sets standards.

There may be other local standards set by counties, cities and municipalities. Be sure to consult all regulatory agencies to assure adherence to all standards in enforcement.

Safety in the workplace is everyone's responsibility. Regardless of the type work you do, it is very important that you pay attention to what you are doing for your safety and the safety of those around you.

The following points are things to keep in mind when working on internal combustion engines and gaseous fuel systems:

- ✓ Before working on any fuel system, study the NFPA standard for the fuel in use.**
- ✓ Before working on any fuel system, read and understand all manufacturers' recommended procedures.**
- ✓ Before working on any fuel system, make sure you have local code approved safety goggles, face shields, gloves and clothing.**
- ✓ Before working on any fuel system, make sure there is adequate ventilation.**
- ✓ Before working on any fuel system, turn OFF the fuel system supply valve and slowly bleed the fuel from all lines before working on the fuel system or engine.**

INTRODUCTION

A. Important Vehicle Owner Advisories:

- At the time of this writing, the Sequent P&D system has not been certified by the California Air Resources Board (CARB). If the vehicle is moved to California, it may not be registered without returning the vehicle to as-close-as-possible to original condition. Please inform the customer that emissions standards vary state to state and to check with the emissions enforcement agency or DMV prior to moving the vehicle into another state. IMPCO is pursuing a (CARB) certification. Contact IMPCO for certification status and updates.
- The EPA certification on the 2009 GM 3.5/3.9L Impala covers vehicles with the E85 fuel option. It is important that the vehicle be run on gasoline with a maximum of 10% alcohol content with the Plug & Drive system. Operation on E85 fuel may cause rough engine running and possible check engine light illumination during or shortly after the changeover to CNG operation. Please advise your customers before installing the system.**

B. SEQUENT P&D 2009 3.5/3.9L Impala Installation Kit Contents:

Remove all kit package contents and verify all parts are included and undamaged. Do not attempt to repair any damaged parts. Contact IMPCO Technologies for replacement of damaged or missing parts.

Part Number	Description	Quantity
SQ-50846-02-0010	Kit, Sequent P&D, Impala 3.5/3.9L CNG Certified	NA
E010M9006	REGULATOR, ZENITH 1/4NPT	1
VI050013	CLAMP, NO.95 FOR 5X10MM HOSE	20
DE802060	SENSOR ASSY, MAP	1
FE077246	FITTING, M6 FUEL END NOZZLE	6
09SQ99020002G	INJECTOR,BRC LPG MAX FLOW,ORNG	6
H1-51561-003-0900	HOSE, BRC CUT, 12MM X 900MM	1
VI050028	CLAMP, NO.170 FOR 12X19MM HOSE	8
21RG99020001	FITTING, 6MM HOSE VACUUM "Y"	1
06LB00001988	SWITCH, FUEL SELECTOR	1
DE524010	HARNESS, P&D 6 CYL, W/PTS CNG	1
09SQ00990002	FITTING, VAPOR FUEL Y, 10X12MM	1
H1-51561-001-0330	HOSE, BRC CUT, 5MM X 330MM	6
16PM00010020	LOCKOFF, HIGH PRESSURE 1/4NPT	1
DE802055	SENSOR, 4 BAR PRESSURE / TEMP	1
21RG03010006	FITTING, 6MM BARBED	1
18CE00010070	MANOMETER, 0-250 BAR, 0-90 OHM	1
06LB50010068	HARNESS, PRESSURE SENSOR	1
H1-51561-002-0900	HOSE, BRC CUT, 8MM X 900MM	1
25TA01010005	FITTING, NYLON "T" 16X16X8MM	2
H1-51561-001-0700	HOSE, BRC CUT, 5MM X 700MM	1
09SQ99030078M	RAIL, BRC FUEL INJECTOR	1
09SQ99030559M	RAIL, BRC INJECTOR W/PTS PORT	1
B4-51389-001	BRACKET, RAIL 1 '08 IMPALA CNG	1
B4-51390-001	BRACKET, RAIL 2 '08 IMPALA CNG	1
N1-30876-M06	NUT, HEX FL SR M6X1.0	4

Part Number	Description	Quantity
S1-30871-02-0616	Screw, Hex Flange, M6 x 16MM	2
S1-30871-02-0612	SCREW, HEX FL M6X12MM	4
L3-50820-016	LABEL, EMISSION GM'09 3.9L CNG	1
S1-30295-0650	SCREW, HEX SOCKET CAP	2
S1-30871-02-0812	SCREW, HEX FLANGE-M8X1.25X12	3
C2-14106-004	Clamp, Hose 5/16"Od 7/8" Gear	4
C2-14106-006	Clamp, Hose 1/2 To 1 1/8 Sae10	4
B4-51391-001	BRACKET, REG '08 IMPALA CNG	1
PPI-A-004	MANUAL, OWNERS SEQUENT P&D CNG	1
PPI-A-005	SEQUENT WARRANTY REGISTRATION	1
H5-15342-1	TUBING, HEATSHRINK 3/16" BULK	4 ft
T4-50880-001	TERM.,EYE 1/4" STUD 12-10 GA	2
T4-50879-001	TERMINAL, WIRE SPLICE 22-16 GA	35
92920000	Washer, Flat M6 DIN 433	2
G3-51280-001	GROMMET, RUBBER 1/4"IDX1"OD	1
S3-51446-002	SPACER, ECM, BRC SEQUENT	2
H1-50912-001	HOSE, FORMED 1/2" ID FUEL	2
FE077245-3	FITTING, M8 FUEL HOSE BARBED	12
FE077244	NUT, M8X1 ES. 10 TURN FITTING	12
DE815186	ECM, P&D '09 IMPALA CNG CERT	1
L3-51732-001	LABEL, MAX W.P. FOR AUTO HOSE	10
W3-14211-000	CONDUIT, ROUND CONVOLUTED	7 ft
L3-51853-001	LABEL, OWNER'S GUIDE ADDENDUM, E85, LPG	2
L3-51854-001	LABEL, OWNER'S GUIDE, E85 NOTICE, LPG	2
L3-51857-001	LABEL, FUEL DOOR E85 NOTICE	2

C. Required Tools, Equipment & Supplies:

- Sequent Installer's Tool Kit (part # 90AV99004048)
- Software Installation Kit (part # 90AV99002055)
- SAE and metric mechanic's hand tools
- Electric or cordless drill and assorted drill bits
- Large hose clamp pliers
- Heat gun
- Soldering iron
- Solder (60/40 electronic rosin core – 0.7 to 1mm diameter works best)
- DVOM and assorted test leads
- Wire/Terminal crimper(s) capable of handling 10-12 gauge (5.5mm²), non-insulated barrel terminals and 18-16 gauge (2.0mm²) "U" style splices
- Wire stripper
- Electrical tape
- PC or laptop with Sequent P&D software installed
- Leakdown tester
- Standard mechanic's diagnostic tools
- OBD-II compliant scan tool (CAN enabled)
- OEM Upper Intake Manifold Gasket Set
- OEM Factory Service Manual
- NFPA approved CNG high-pressure tubing and fittings as necessary
- OEM touchup paint to match vehicle

D. Torque Specifications:

- CNG high pressure filter mounting (banjo) bolt..... 15-22 ft-lbs (20-30 Nm)
- CNG high pressure filter blocking screw..... 37-52 ft-lbs (50-70 Nm)
- CNG manometer..... 15-30 ft-lbs (20-40 Nm)
- CNG pressure / temperature sensor..... 20.5-23.5 ft-lbs (28-32 Nm)
- Regulator Temperature Sensor 89 in-lb (10 Nm)
- MAP sensor mounting nut 20.5-23.5 ft-lbs (28-32 Nm)
- Fuel nozzles..... Hand tight + ¼ turn
- BRC Injector mounting nuts 71 in-lbs (8 Nm)
- Fuel hose & manifold vacuum hose adapter nuts (8mm)..... 62 in-lbs (7 Nm)
- Zenith regulator mounting bolts (8mm)..... 15 ft-lbs (20 Nm)

E. Installation Notes:

- Anytime the OEM painted surface is broken by drilling, component removal, etc, the exposed metal surfaces must be protected from corrosion. This is especially important in areas where salt is used on the roads during the winter months. GM recommends their *Super Lube with PTFE* (part #12371287, GM bulletin # 03-00-89-008D). Follow the instructions in the bulletin to ensure a positive outcome.
- DO NOT use Teflon tape on any fittings. Teflon tape may get into the regulator primary and secondary seats and the fuel injector seats causing fuel pressure problems. Any warranty returned item found contaminated with Teflon tape will be returned.

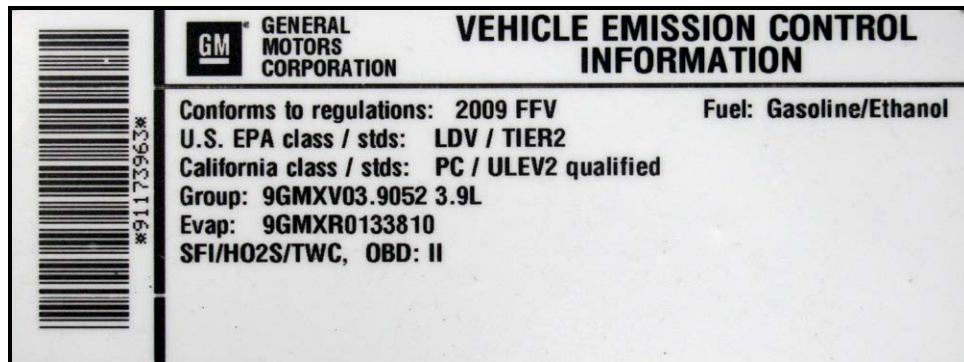
INSPECT FOR CORRECT VEHICLE INFORMATION AND THE OPERATIONAL INTEGRITY OF THE ENGINE

Installing an alternative fuel system into a vehicle with an engine or ignition system that is in poor condition will produce less than desirable results and may lead to exhaust emissions beyond acceptable levels. It is strongly advised that all of the following inspections be done **BEFORE** installing the Sequent P&D system.

A. Preliminary Inspection:

The preliminary inspection should consist of a visual inspection of the following items:

- Emissions Label for correct Model Year, Engine Group, Evaporative Emissions Family and Engine Type:
 - Model Year: 2009 ONLY
 - Engine Group: 9GMXV03.9052 ONLY
 - Evaporative Emissions Family: 9GMXR0133810 ONLY



Correct MY, Engine Group & Evaporative Emissions Family.

NOTE: If the Emissions label identification information does not match exactly, you **CANNOT** install the system in the vehicle. Installation in a non-certified vehicle may be punishable by a fine and/or imprisonment.

- Air filter and intake plumbing condition.
- Engine gaskets and seals for leaks.
- Exhaust system condition.
- Cooling system for leaks.
- Under-hood wiring and hose condition.
- Inspect the secondary ignition wires, ignition coils and suppressor caps for any signs of damage or wear.
- Repair or replace any faulty items.

B. Scan Tool Inspection:

Connect an OBD-II compliant scan tool to the vehicle DLC connector and check the following:

- Active or Historic fault codes (follow the OEM's diagnostic recommendations for any codes found and make necessary repairs).
- OBD monitors for completion and passed tests.
 - If all applicable monitors have not completed, drive the vehicle until they have completed and passed.
 - If any monitors have failed a test, follow the OEM's diagnostic recommendations and make any necessary repairs.

C. High Mileage Vehicle Inspection (75k+) or scan tool not available:

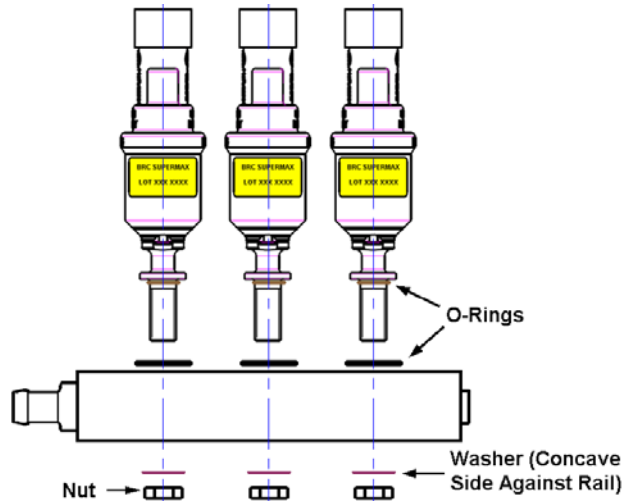
High mileage vehicles require further inspection. The following items require physical inspection:

- Start the engine and inspect the exhaust for signs of excessive smoke.
- Remove the engine dip stick and inspect the oil condition. Change oil and filter if necessary.
- Remove and inspect spark plugs. Replace the plugs if any are found to be worn, show signs of gas fouling or oil contamination.
- Perform a leak-down test.

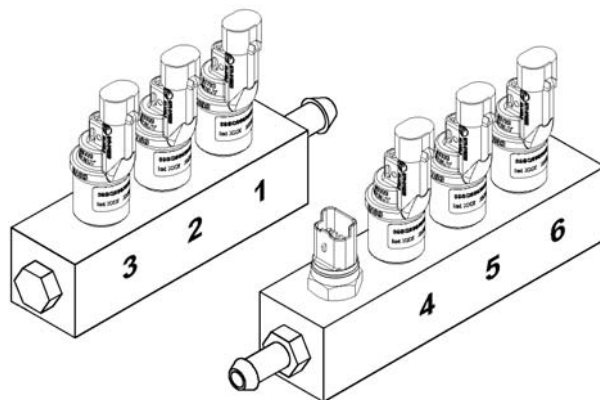
MAKE ANY NECESSARY REPAIRS BEFORE INSTALLING THE SEQUENT SYSTEM.

SEQUENT P&D INSTALLATION

A. Pre-Installation Bench Assembly:

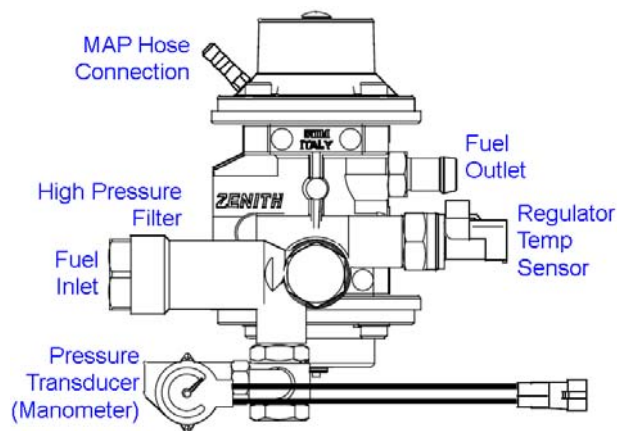


- 1) Locate the six fuel injectors and both fuel rails. The injectors will be installed into the rails as illustrated.



- 2) Install three Sequent injectors into each of the fuel rails and torque the injector nuts to 71 in-lb (8 Nm). Install the Fuel Temperature / Pressure Sensor into the longer of the two rails and torque the sensor to 20.5-23.5 ft-lbs (28-32 Nm).

NOTE: Numbering the fuel rail as illustrated will help when connecting the harness to the injectors.



- 3) Install the Regulator Temperature Sensor onto the Zenith Regulator and torque it to 89 in-lb (10 Nm).

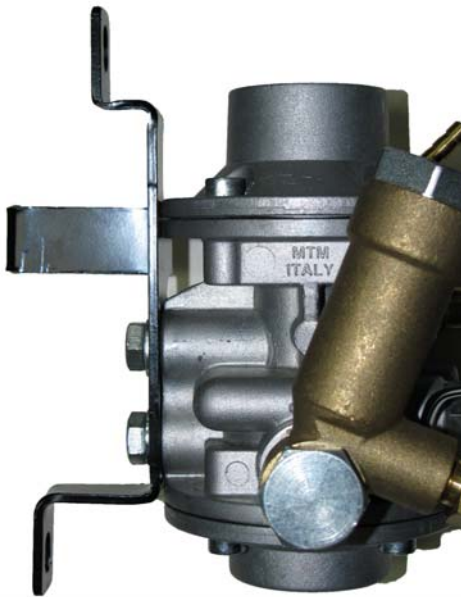
- 4) Insert the aluminum sealing washer into the CNG manometer receiver on the high-pressure filter and install the manometer. Tighten the manometer so it is in the approximate position keeping the torque between 15-30 ft-lbs (20-40 Nm).

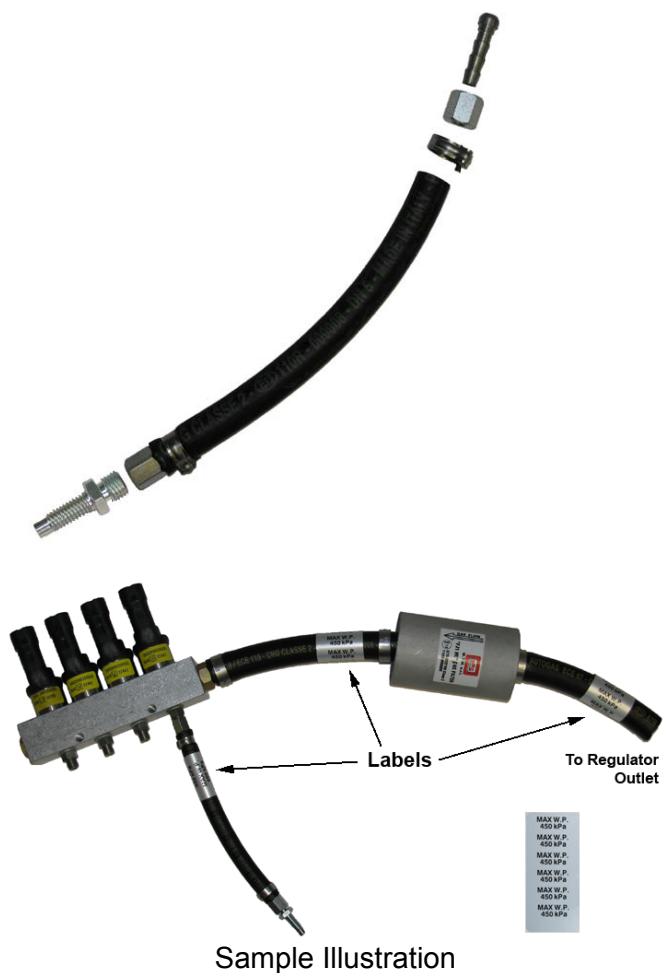


- 5) Install the High Pressure Filter onto the regulator. Rotate the filter to the position shown and torque the banjo bolt to 15-22 ft-lbs (20-30 Nm). DO NOT over-tighten!



- 6) Lightly apply Loxeal to the two regulator bolt threads and install the regulator onto the bracket.





- 7) Assemble the fuel hoses by inserting the barbed hose fittings through the 8mm special nuts and into the ends of the fuel hoses. Install two clamps over the hoses centering them over the barbed fittings and clamping them with the hose clamp pliers.
- 8) Thread the fuel nozzles into one end of the fuel hoses and torque them to 62 in-lbs (7 Nm).

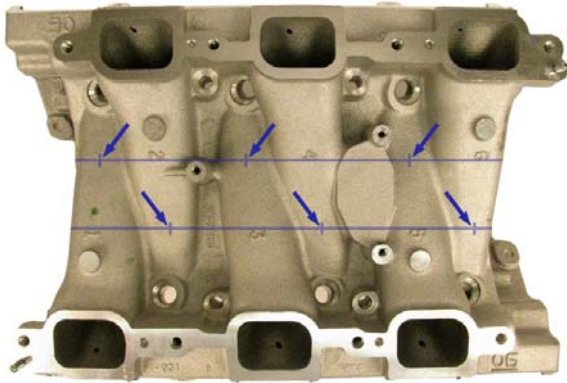
NOTE: Hose illustrated not actual length.

- 9) After all fuel hoses have been cut to length and assembled, wrap one of the maximum fuel working pressure labels around EACH hose.
- 10) Wrap the label around the hose "Towards one end of the hose" (as illustrated). DO NOT affix the label along a bend in the hose as it may cause a kink in the hose restricting fuel flow.
- 11) **One of these labels must be affixed to every fuel hose between the regulator outlet and the intake manifold to comply with government regulations.**

B. Intake Manifold, Ignition Coil Pack and Air Filter Housing Removal:

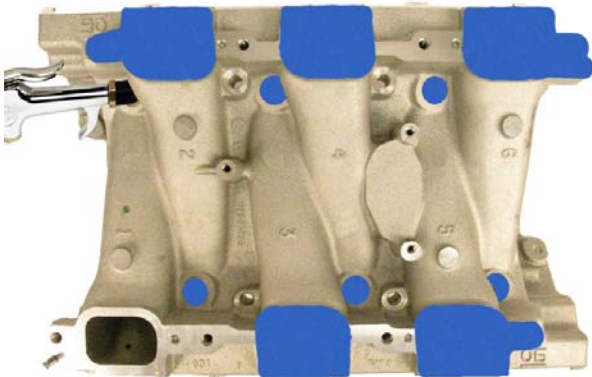
Prior to any disassembly, clean the engine and engine compartment (with engine degreaser where necessary). Disconnect the negative battery cable followed by the positive battery cable and remove the battery from the vehicle. Following the manufacturer's service manual instructions, remove the upper intake manifold, then the ignition coil pack. Remove the air filter housing to expose the ECM.

C. Intake Manifold Modifications:



- 1) Using a straight edge, draw two lines along the intake manifold keeping the straight edge just inboard of the runner numbers. Using a center punch, make a small dimple where the lines intersect in the photo (arrows).

NOTE: Lower intake manifold has been removed from the engine for clarification. DO NOT remove the lower intake manifold from the engine.



- 2) Before drilling & tapping the runners, cover all of the intake ports and OEM injector holes except for those on the runner you will be drilling & tapping. Using a rubber tipped blow gun, blow air into the runner being drilled and tapped so all metal chips will be carried out of the runner through the intake runner opening. Also, incorporating a wet/dry vacuum on the intake runner opening will help evacuate metal chips from the runner.

i IMPORTANT: Make sure the intake valve for the cylinder you are working on is completely closed. If not, rotate the engine by hand until it is.



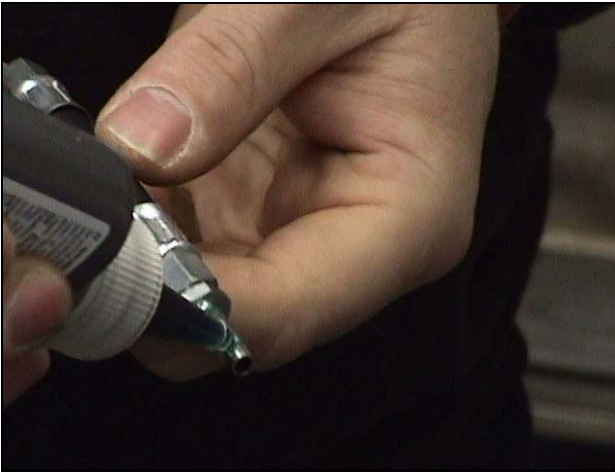
BE SURE to wear goggles and a face mask to protect your eyes from flying particles.



- 3) While blowing air through one of the runners, and using one of the 5mm drills in the Sequent Installer's Tool Kit, drill through the top intake manifold runner wall keeping the drill perpendicular to the runner face. **DO NOT** drill into the bottom wall of the runner.



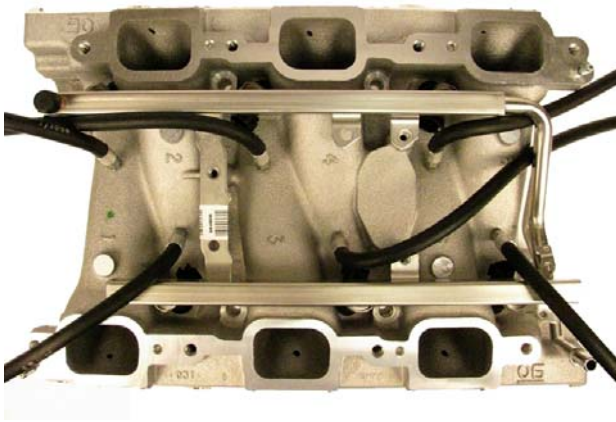
- 4) Attach the long tap handle to the combination 6x1mm tap & drill. Apply a light coat of tapping oil to the tap threads and tap the nozzle hole keeping the tap perpendicular to the runner face. Repeat steps 3 – 5 for the remaining five intake runners. When finished, clean all traces of metal chips from the intake runners.



- 5) Apply a light coat of Loxeal to each of the fuel hose nozzle threads.



- 6) Thread the fuel hose/nozzle assemblies into the tapped holes. Using the nozzle crow's foot tool (or 10mm wrench) tighten each fuel hose/nozzle assembly approximately $\frac{1}{4}$ turn past hand-tight.



- 7) Apply some clean engine oil to the OEM injector o-rings and install the OEM fuel injector rails torquing the bolts to OEM specifications.

Intake manifold with OEM fuel injector rails installed and Sequent fuel hoses routed correctly.

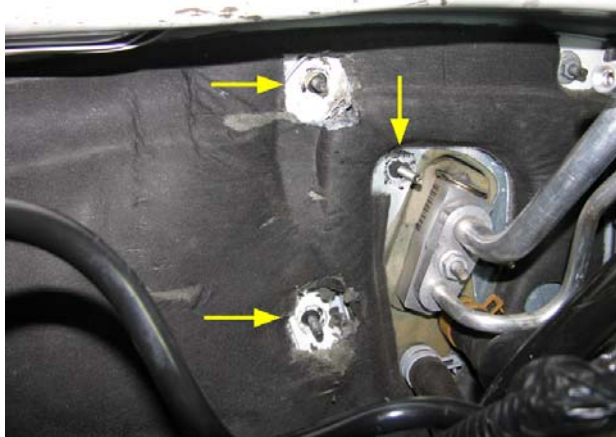


- 8) Drill and tap the upper intake manifold for the brass vacuum port adapter using the 5mm drill and the 6mm tap. Clean all traces of metal chips from the manifold. Apply a light coat of Loxeal to the adapter threads before installing.

Set the upper manifold aside in a clean area protected from dirt and debris.

Cover the lower manifold to keep dirt and debris from entering the intake runners.

D. Zenith Regulator and Coolant Hose Installation:



- 1) The Zenith Regulator will be installed in the center of the bulkhead utilizing three existing studs.

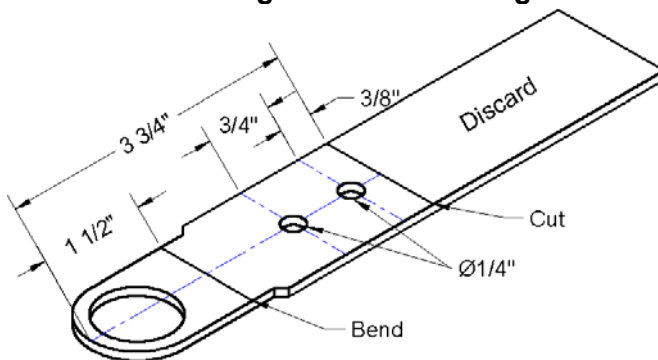


Heater hoses with Tees and Regulator Coolant Hoses installed

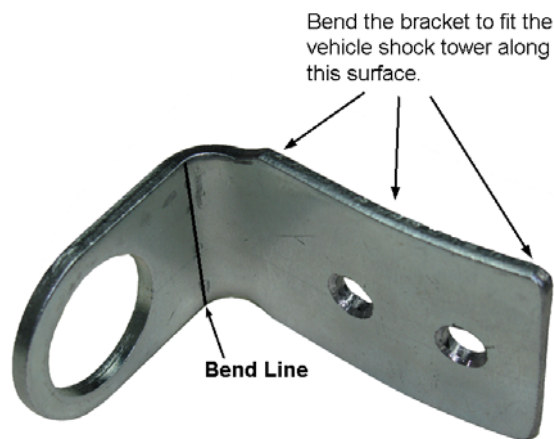


- 2) Begin modifying the heater hoses by pinching them with four hose pliers to make room for the two plastic Tees.
- 3) Cut the heater hoses between the clamps, install four hose clamps onto the hoses and install the two plastic Tees.
- 4) Temporarily install the Regulator and cut two lengths of the Regulator Coolant Hose to fit between the two Tees and the Regulator coolant hose nipples.
- 5) Slide hose clamps onto the two hoses and install them onto the Tees.
- 6) Tighten the six clamps on the Tees and remove the hose pliers.
- 7) Slide two more hose clamps onto the Regulator Coolant Hoses, install the hoses onto the Regulator and tighten the clamps.
- 8) Install the Regulator onto the engine compartment rear bulkhead studs.

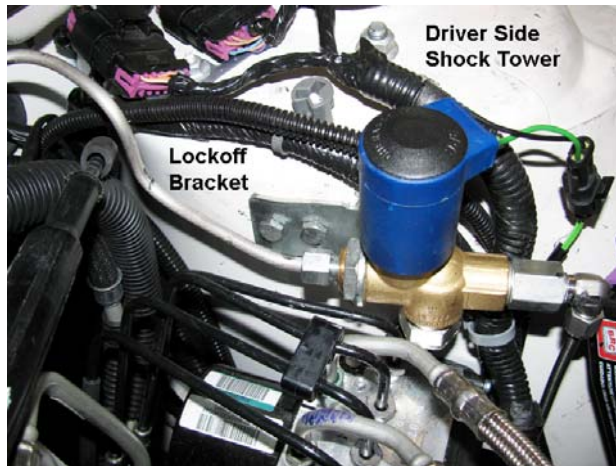
E. Lockoff and High Pressure Tubing Installation:



- 1) Locate the Lockoff bracket and mark it for modification as illustrated. Cut off the end of the bracket, drill two $\frac{1}{4}$ " diameter holes as indicated and bend the bracket 90° where indicated. Round off any sharp corners with a file or grinder.



- 2) The bracket will be mounted on the driver's side shock tower close to the top. Bend the bracket as illustrated to approximate the mounting surface of the shock tower.

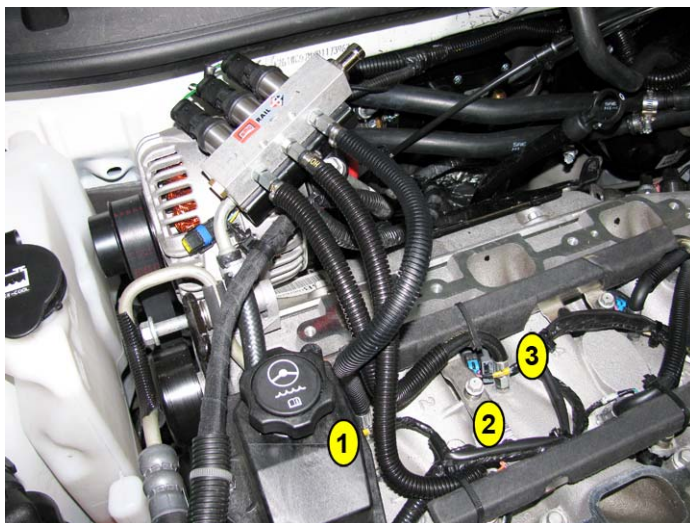


- 3) Install the Lockoff onto the bracket as illustrated. Using the bracket as a template, drill two 1/4" diameter holes in the shock tower. Mount the Lockoff and bracket to the shock tower.

i IMPORTANT: If the vehicle has ABS, be sure to allow for clearance between the Lockoff and the ABS Unit / lines.

- 4) Using code approved fuel line and fittings, fabricate a fuel line to connect between the lockoff and the regulator.

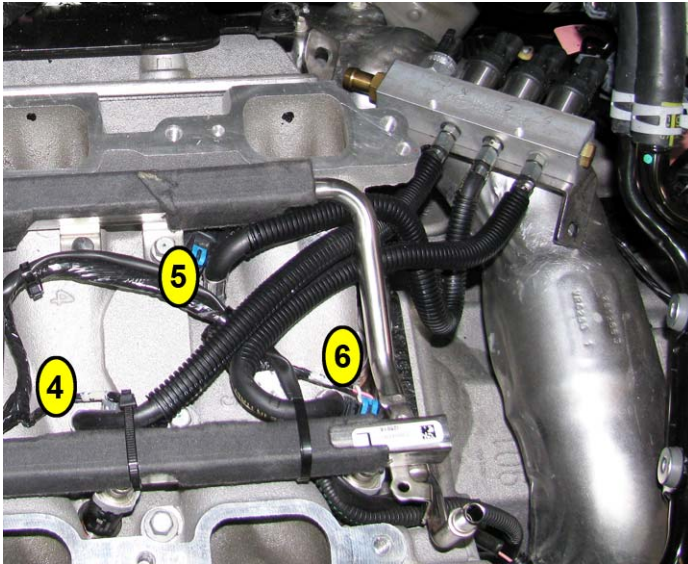
F. Fuel Rail Installation:



- 1) Wrap each of the six fuel hoses with corrugated conduit (make sure the max wp labels are installed first).
- 2) Mount the 1-3 fuel rail onto its bracket. Attach fuel hoses 1-3 to the appropriate injector routing the hoses as indicated in the photo.
- 3) Tie-wrap #2 & 3 hoses to the OEM fuel rails where indicated in the photo.



1-3 Fuel Rail Bracket



- 4) Mount the 4-6 fuel rail onto its bracket. Attach fuel hoses 4-6 to the appropriate injector routing the hoses as indicated in the photo. Tie wrap #4 & 5 hoses to the OEM fuel rails where indicated in the photo.



4-6 Fuel Rail Bracket

G. CNG Low Pressure Hose Connections:



Low Pressure Fuel Hoses Installed

- 1) Locate the two preformed low pressure fuel hoses, the length of bulk fuel hose and the fuel splitter "Y".
- 2) Install the short preformed hose onto the Regulator fuel nipple, slide two fuel hose clamps onto the hose and install the other end onto the single "Y" inlet nipple.
- 5) Slide two fuel hose clamps onto the other preformed hose and install the end with the sharp bend onto one of the "Y" outlet nipples and the other onto the 4-6 fuel rail inlet nipple.
- 6) Position the two fuel rails approximately in their installed locations and cut the bulk fuel hose to length to fit between the other "Y" outlet nipple and the 1-3 fuel rail. Install two fuel hose clamps onto the hose and install it.
- 7) Secure all fuel hose clamps with the hose clamp pliers in the Sequent Installer's Tool Kit.
- 8) Re-install the ignition coil pack.

H. Sequent / OEM Electrical Connections:

Proper Wire Splicing

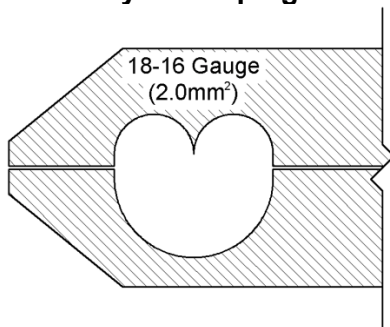
Terminal Crimping Types:

There are two types of terminals used in the installation of the Sequent P&D wiring harness. To ensure a good crimp, use the appropriate style crimping tool (including correct gauge) as illustrated below.

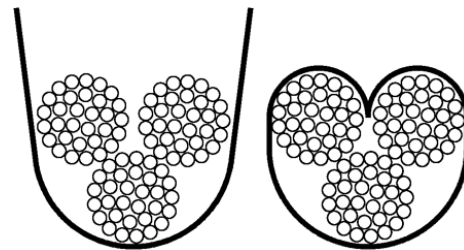
NOTE: Not all crimping tools are made exactly the same. Experiment with different tools to achieve the best crimps possible before working on the vehicle's wiring harness.

The first is the "U" style splice crimp used to splice the Sequent P&D harness circuits to the OEM harness circuits.

"U" Style Crimping Tool

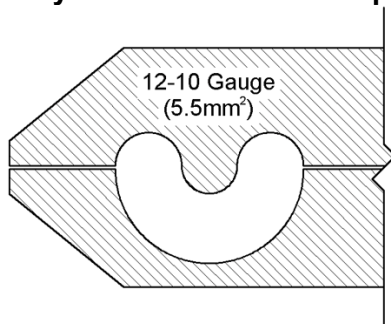


"U" Style Crimp (Before & After Crimping)

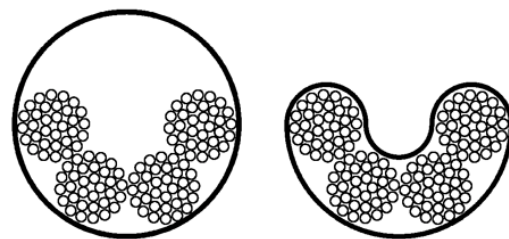


The second is the "Barrel" style, non-insulated lug terminal used to connect the Sequent P&D harness to the battery post terminals.

"Barrel" Style Non-Insulated Crimping Tool



"Barrel" Style Crimp (Before & After Crimping)

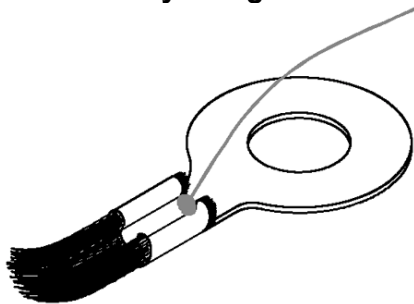


IMPORTANT NOTE: After crimping either style terminal, be sure to solder the connection as illustrated on the next page before shrink wrapping.

Soldering Crimps & Terminals:

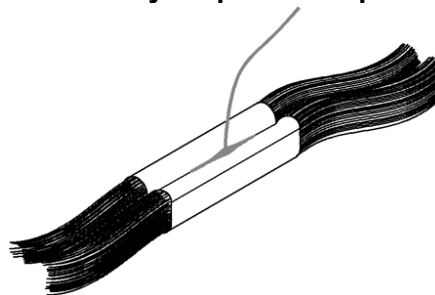
Solder all terminals after crimping as illustrated using an electronic grade, rosin core solder (0.7 to 1.0mm diameter works best). Make sure all wires in the terminal receive adequate solder to ensure a permanent connection.

“Barrel” Style Lug Terminals



Heat the terminal and apply the solder from the lug side of the crimp to minimize “wicking” solder up the wires, which may lead to wire breakage. Securing the wires to the battery cables will help minimize this risk.

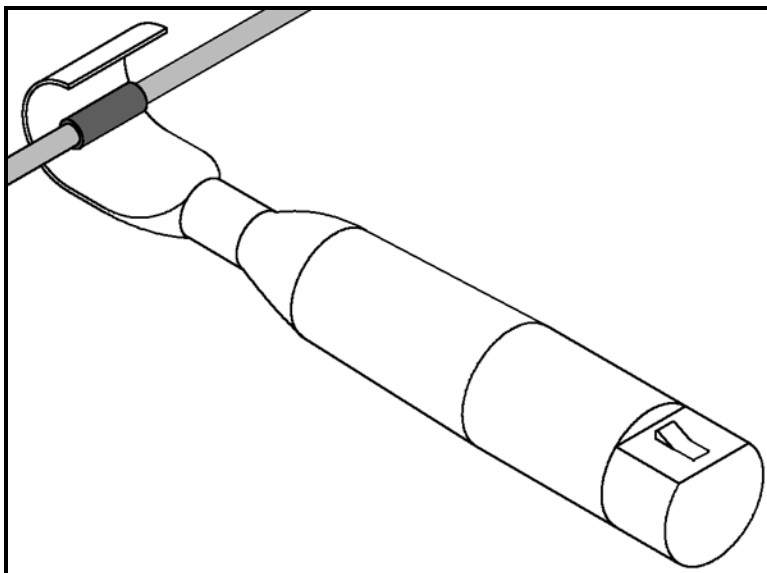
“U” Style Splice Crimps



Heat the terminal and apply the solder in the center of the crimp fold, allowing it to “wick” into the joint. Do not worry if some of the solder wicks into the wires as they will be secured by the wiring loom.

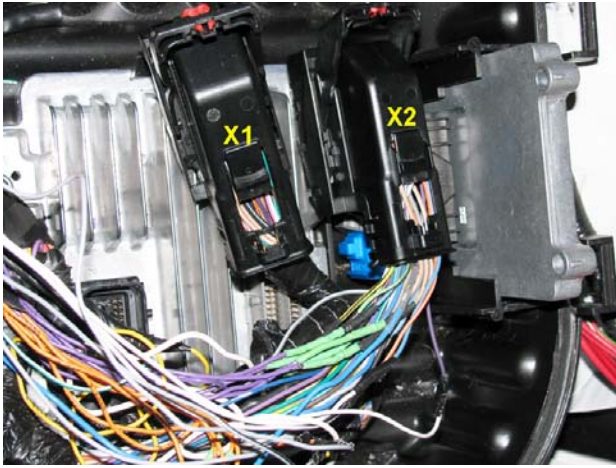
Shrink Wrapping Connections:

Shrink wrap all splices and the positive battery lug. Cut the adhesive lined shrink tubing into 1 to 1 ½” (25-38mm) pieces. Use a heat gun with a U-shaped nozzle to heat the shrink tubing uniformly as illustrated.



IMPORTANT!

Familiarize yourself with ALL schematics and electrical diagrams BEFORE splicing wires. Some of the modules and Sequent ECU share the same electrical connections (splices).

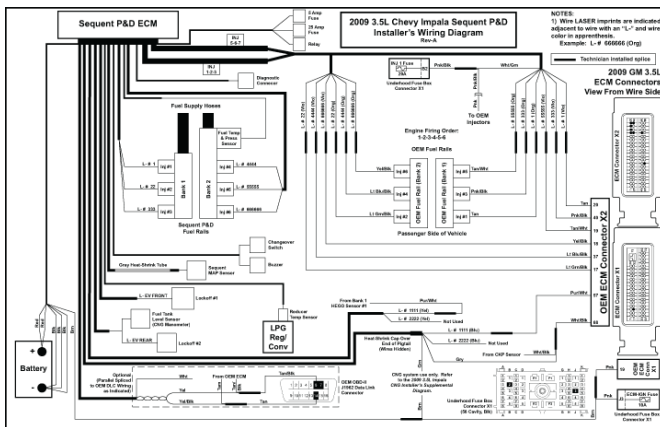


- 1) Disconnect both connectors from the OEM ECM. Layout the Sequent wiring harness with all pigtails approximately where they will be installed.
- 2) Carefully remove the wiring cover from the back of the OEM ECM connectors X1 & X2.
- 3) Remove the harness tape and conduit to expose the ECM connector wiring.

OEM ECM harness with modifications completed and ready for retaping.



- 4) Locate both injector pigtails on the Sequent P&D harness (labeled: *Inj 1-2-3-4 BENZ* and *Inj 5-6-7-8 BENZ*). Cut the connectors off of both pigtails.

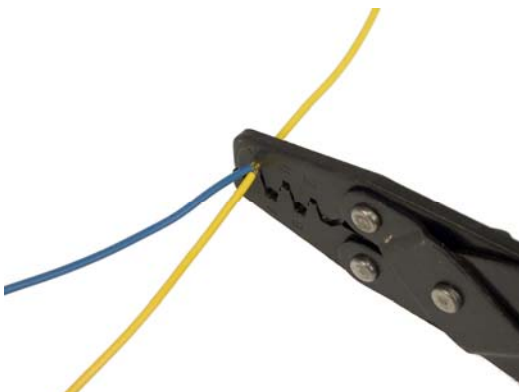


- 5) Cut the adhesive-lined shrink-wrap into 1 to 1 1/4" strips. Install one of the strips over the first wire to be reworked.
- 6) Steps 6 through 9 should be done on the wires one-at-a-time. Referring to the *2009 3.5L Impala P&D Installer's Wiring Diagram*, cut each wire at the ECM indicated on the diagram. Strip the ends of the wires in preparation for crimping and soldering.

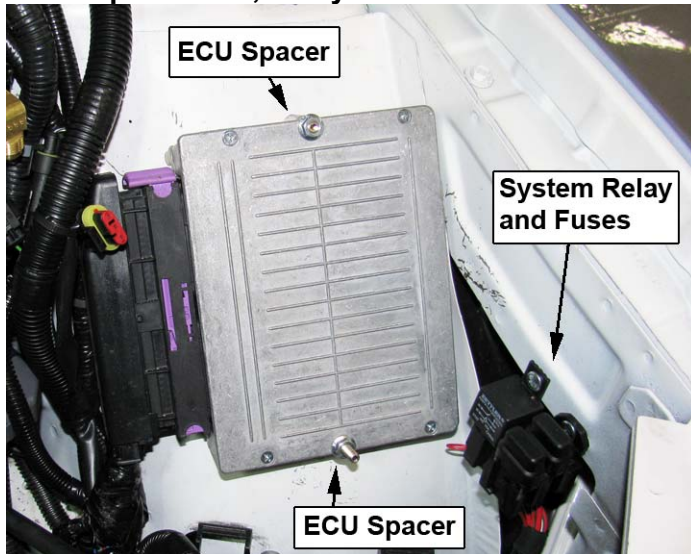
i Important: Make sure to cut the wires so there is adequate space between the splice and the ECM connector to allow for repacking the wires into the harness conduit.

- 7) Position the wire ends in one of the "U" shaped crimps and securely crimp the wires together (parallel splice illustrated).
- 8) Solder the connection.
- 9) Apply the shrink-wrap to the splice.
- 10) Repeat until all circuits have been reworked.

NOTE: The OBD-II connections cannot be made until the interior harness pigtail has been installed.



I. Sequent ECM, Relay & Fuse Locations:



- 1) Install the Sequent ECM (with spacers), relay and fuses where indicated.

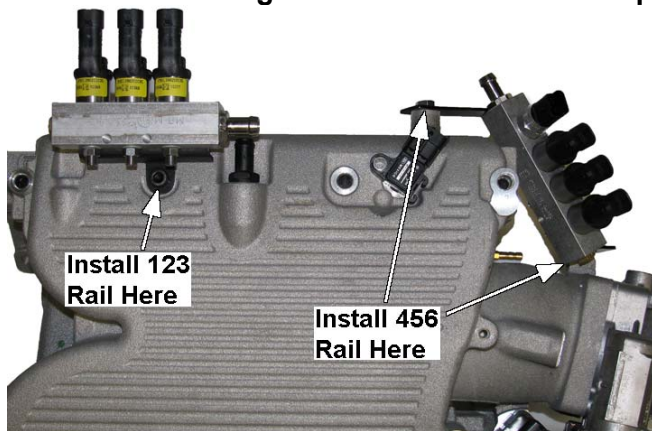
J. Battery Connections:

Crimp and solder the terminals onto the red and black battery wires.

NOTES:

- The B+ connection can be made directly to the battery or fuse box. DO NOT connect to any circuit directly connected to the alternator/generator.
- The B- connection can be made directly to the battery or engine/chassis ground. DO NOT connect to ground near the alternator/generator due to electrical noise.

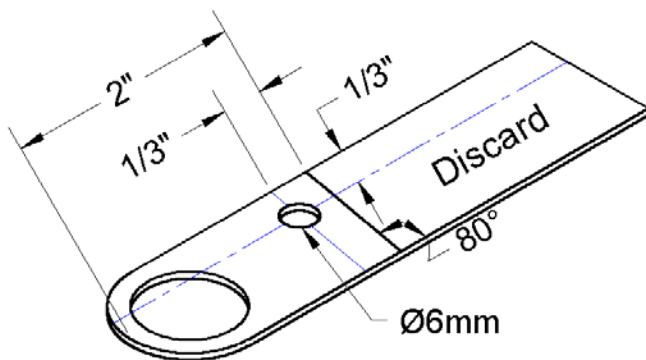
K. Re-install the Ignition Coil Pack and the Upper Intake Manifold.



- 1) Following the OEM installation procedures, re-install the ignition coil pack and (using new gaskets) the upper intake manifold with the Sequent injector rail brackets.

Manifolds removed from engine for clarification purposes only.

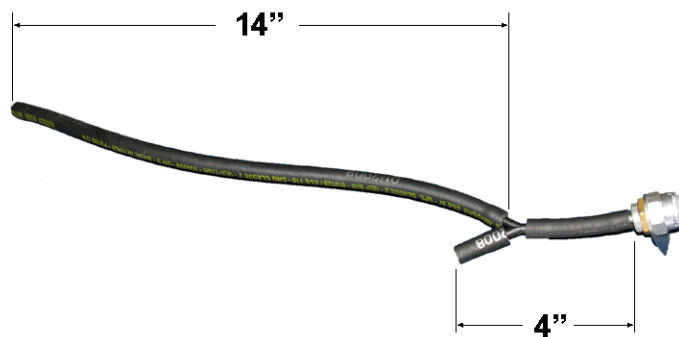
L. Sequent MAP Sensor Installation:



- 2) Fabricate the MAP Sensor bracket as illustrated. Mount the MAP sensor in the bracket torquing the nut to 20.5-23.5 ft-lbs (28-32 Nm).



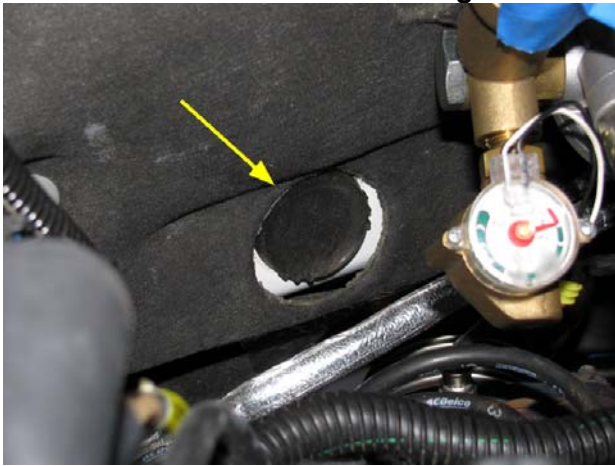
MAP Sensor Bracket



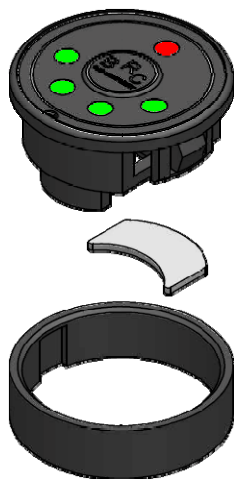
- 3) Cut the MAP sensor vacuum hose to match the illustration.
- 4) Remove the right upper Throttle Body mounting bolt and secure the assembly to the Throttle Body.
- 5) Connect the short hose to the vacuum nipple on the upper intake manifold and the long hose to the vacuum nipple on the regulator.



M. OBD-II Connections and Changeover Switch / Buzzer Installation:



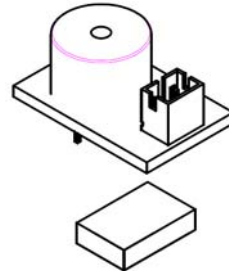
- 1) Remove the grommet on the passenger side of the bulkhead. Split the grommet with a razor blade just enough to push the Changeover Switch and OBD-II pigtails through. Push the changeover switch connectors through the hole, re-install the grommet and seal it with a little black RTV Sealant.
- 2) Make the OBD-II connections illustrated in the *2009 3.5L Impala P&D Installer's Wiring Diagram*.



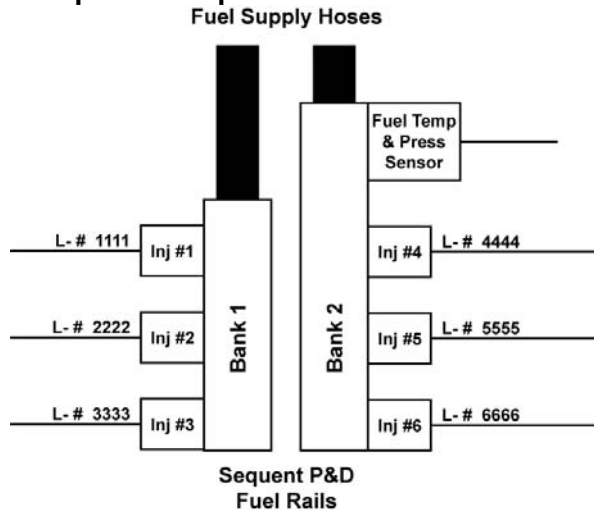
- 3) The Changeover Switch can be installed in either a 9/16" diameter hole or a 7/8" diameter hole. The 7/8" hole is preferable if the location surface is textured and less than 3/32" thick. If the 9/16" hole is to be used, attach the double-sided tape onto the back of the switch. If the 7/8" hole is to be used, remove the outer bezel from the switch.



- 4) The Changeover Switch installation location is a somewhat a matter of customer preference. However, make sure the Changeover Switch pigtail is long enough for the customer's preference. If not, make suggestions for alternative locations.
- 5) The Buzzer is installed by installing the double-sided tape to the back of the buzzer and sticking to a clean smooth surface on the back of the dash panel.



N. Sequent Component Electrical Connections:



- 1) Connect the Sequent injector connectors. Match the number on the injector wiring to the CNG injector as illustrated.

Failure to follow this order will result in a rough fuel change over and reduced performance on CNG. Refer to the *2009 3.5L Impala P&D Installer's Wiring Diagram* for additional information.

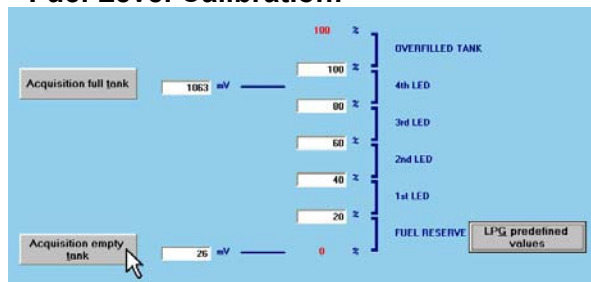
- 2) Connect the fuel temperature / pressure sensor.
- 3) Connect the regulator temperature sensor.
- 4) Connect lockoff.
- 5) Connect the Sequent ECM.

O. Final Connections:



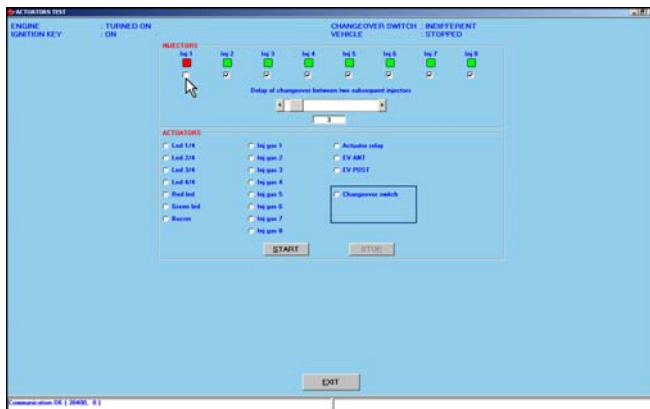
- 1) Connect the high pressure CNG line to the lockoff. Leak test the entire Sequent and OEM fuel systems with applicable code approved equipment before starting the engine.
- 2) Reconnect all OEM components except for the engine cover.
- 3) Reinstall the battery. If the installation requires the Sequent B+ and B- connections be made at the battery, connect them now.

P. Fuel Level Calibration:



- 1) Perform the fuel level calibration as described in the *Sequent P&D Display Software User Manual*.

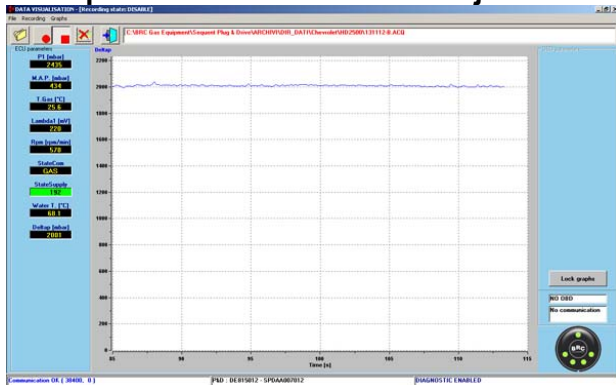
Q. Initial Engine Start:



- 1) After making all fuel system leaks and installation inspections:
 - Switch the changeover switch to Gasoline operation (red FOIL).
 - Connect an OBD-II scan tool to the OEM DLC connector.
 - Connect the Sequent DLC cable to the vehicle and the laptop.
 - Open the Sequent P&D software and start the engine.
 - With the OBD-II scan tool, verify there are no pending or hard codes. If any codes appear, diagnose the cause and repair before continuing.

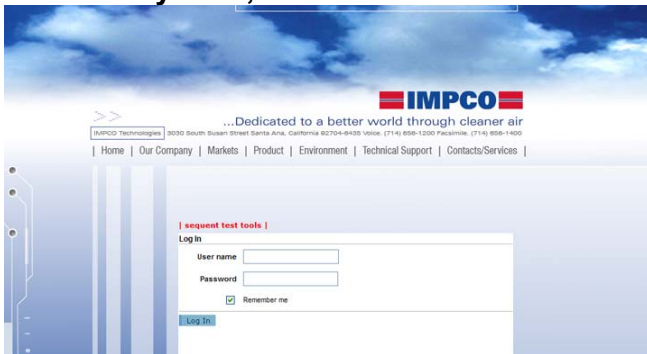
- 2) Let the engine warm up to operating temperature, then depress the changeover switch for gaseous operation position. When the system begins changing over to CNG operation the engine should continue running without hesitation or stumbling. If the engine begins running rough during the changeover cycle, then 2 or more of the injector connectors are misplaced. Perform the Injector Changeover Test [Diagnostics section of the *Sequent P&D Display Software User Manual (Cert)*].

R. Sequent “Delta-P” Pressure Adjustment:



1. With the engine idling, running on CNG and at operating temperature, open the display software and select the “Delta P” pressure for graphing (see the Diagnostics section in the *Sequent P&D Display Software User Manual* for graphing instructions). The “Delta P” pressure should be averaging at approximately 2000 mbar. If it is not, make adjustments with a 4 mm allen wrench at the regulator.

S. Warranty Card, Emissions Label & Owner's Guide:



- 1) Warranty registration is available on IMPCO Technologies' Website:

<http://www.impcotech.com/sequent-tools.asp>
(requires login).

If Internet registration is not possible, fill out the warranty card completely and drop it in the mail or fax it to:
714 656-1414

The screenshot shows the "sequent test tools" section of the IMPCO Technologies website. It features a "Sequent Warranty Registration" form. The form has two tabs: "Sequent 56" (selected) and "Plug & Drive". The "Sequent 56" tab contains fields for "Vehicle Identification Number (VIN)", "Make", "Model", "Year", "License Plate", "State / Prov", "City", "State / Prov", "Zip / Postal", "Telephone", "Odometer Reading at Install", "Date Install Completed", "Enter Security Code", and a "Submit" button. A note at the bottom states "All fields are mandatory".

The physical warranty registration form for IMPCO Technologies. It includes fields for "SEQUENT Installation Registration" (with checkboxes for "P&D" and "56"), "Vehicle Identification Number (VIN)", "License Plate", "State", "Owner's Name", "Address", "Phone", "Installer's Name", "Address", "Phone", "Odometer Reading at Time of Installation", "Date of Completed Installation", and "E-mail Address". A note at the bottom states "To be Completed and Mailed by the Installer".

IMPCO TECHNOLOGIES INC
3030 S SUSAN ST
SANTA ANA CA 92704-6435

Place
Stamp
Here



- 2) Fill out the Emissions Label completely and attach it where illustrated.



- 3) Install the Fuel Door E85 Notice label on the inside of the fuel door.



Owner's Guide Supplement
for SEQUENT Plug & Drive
Equipped Bi-Fueled Vehicles



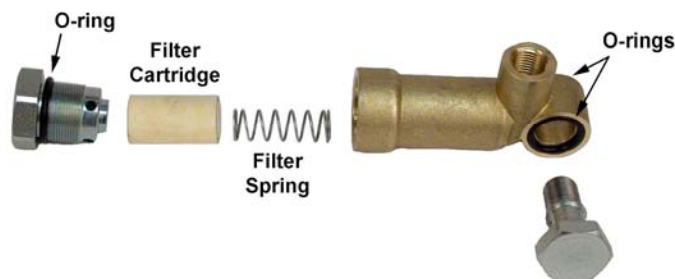
- 4) Put the Sequent P&D Owner's Guide in the a prominent location on the dash or center console where the customer can easily locate it. It is strongly recommended to go over some of the highlights of the Owner's Guide with the customer.

T. Maintenance:

Maintenance consists of:

- Periodic visual inspection of all vacuum lines and fittings.
- Periodic visual inspection of all fuel lines and fittings.
- Periodically check entire intake system for vacuum leaks.
- Periodically check condition of all wiring.
- Periodic CNG lockoff fuel filter replacement.
- "Delta-P" fuel pressure manual inspection / adjustment.

Except for the "Delta-P" pressure check, all other maintenance items are in the *IMPCO Owner's Guide Supplement*. Consult the guide for maintenance schedules.



- 1) The Lockoff fuel filter replacement requires the following parts:

Part #	Description	Qty
02BM03990001	Kit, Filter	1

PPI-A-021

Rev-B

August 09

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Sequent P&D ECM

2009 3.5/3.9L Chevy Impala Sequent P&D Installer's Wiring Diagram

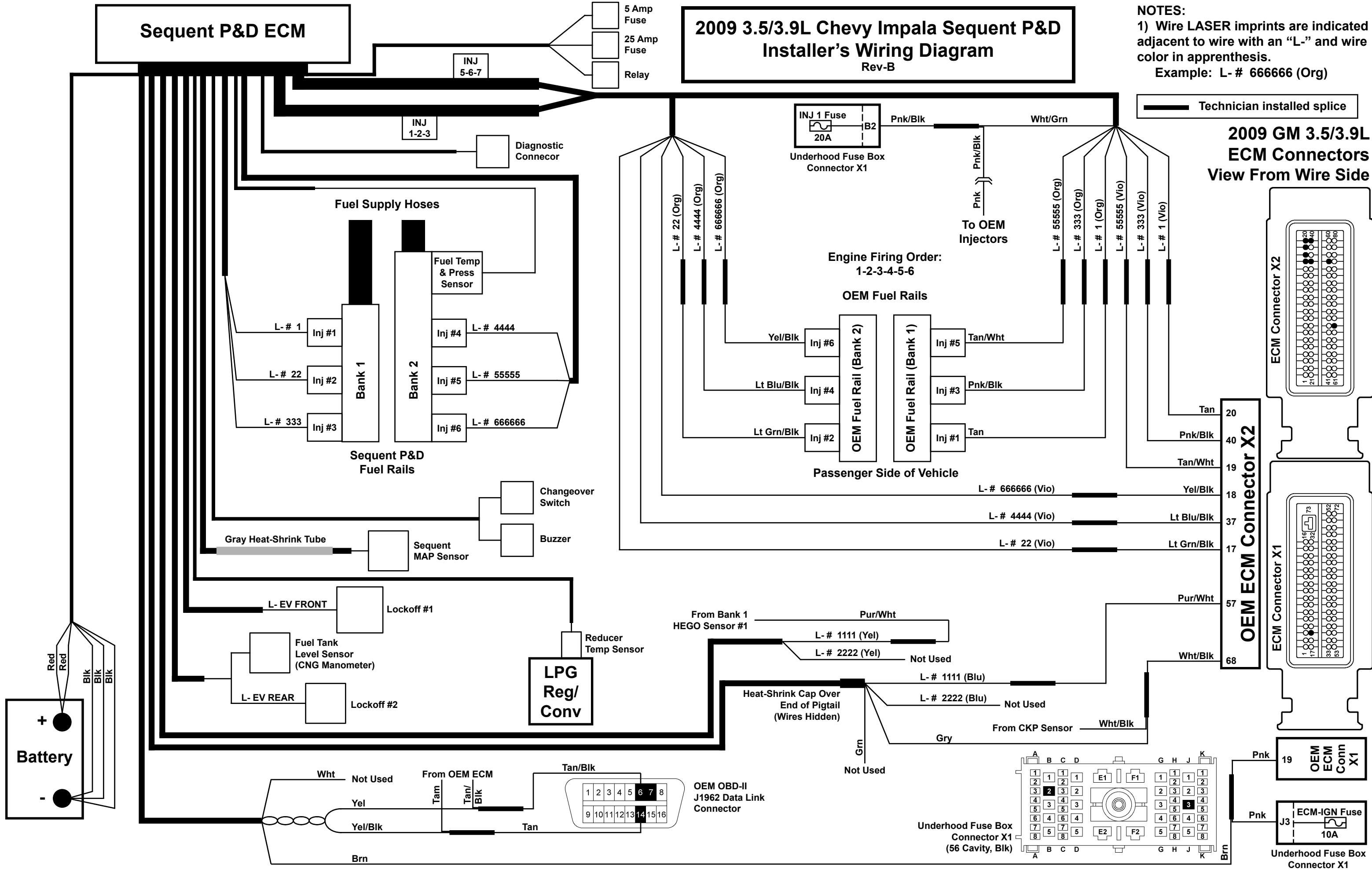
Rev-B

NOTES:

1) Wire LASER imprints are indicated adjacent to wire with an "L-" and wire color in apprenthesis.
Example: L- # 666666 (Org)

Technician installed splice

2009 GM 3.5/3.9L ECM Connectors View From Wire Side



**Sequent P&D
Wiring Schematic
2009 3.5/3.9L
Chevy Impala
Rev-B**

Technician Installed Splice

Sequent P&D ECM

